

Possibilities and limitations of protein supply in organic poultry and pig production

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Summary of a preliminary project report in Organic Revision Project

Introduction

One of the main objectives of organic agriculture is to establish a largely closed nutrient cycle within the farm system. To limit the input of nutrients in quantity and quality is relevant both to plant and livestock production. If nutrient input is unavoidable to ensure an adequate supply for the farm animals, this should preferably originate from organic systems, while the input of conventional feed stuffs should be restricted to a minimum, and synthetic products are banned. Dealing with limited availability of feed and nutrient resources is therefore a main feature of organic livestock production.

The organic approach stands in contrast to the situation in conventional livestock production where the use of feeds and nutrients is restricted primarily by the purchase price. While conventional production has to face various local, regional and global problems caused by excess import and use of concentrated feeds, problems of organic livestock production are primarily related to a lack of nutrients at the farm or herd level. Due to these system-related conditions, there is concern about been able to formulate adequate rations for the nutritional-physiological needs of livestock, especially in relation to essential amino acids in the feeding of poultry and pigs. Nutritional imbalances encountered in practice might lead to deteriorating animal health and welfare.

On the other hand, there is also concern that allowing conventional feedstuffs to be fed in organic livestock production. This could result in intensification of production, causing the same problems in organic as in intensive livestock production, such as animal health problems, risk of residues and GM contamination. Thus, extending the derogation for conventional feed in the EU regulation may have a damaging effect on consumer confidence in organic animal products.

Work within an the EU funded research project “Organic Revision” (Research to support the revision of the EU Regulation on Organic Agriculture) has the aim to provide knowledge on how to achieve 100% organic feed rations for livestock and simultaneously avoid negative effects on the farm animals. The first step in the project is to obtain an overview of the many different and system related aspects of the protein supply in organic poultry and pig production. The nutritional-physiological effects of a variation in protein supply with respect to growth performance and protein accretion in broilers, turkeys, laying hens and pigs are examined by literature review. Furthermore, the potential effects of the supply with amino acids on product quality and animal health and welfare are addressed. Many different aspects are taken into account to discuss the question of whether extending the derogation concerning

the use of non-organic feedstuffs should be considered with respect to the objectives and framework conditions of organic livestock production.

Organic approach

In conventional livestock production, supply of nutrients closely related to the specific requirements of animals at various stages of their development is an important tool in a performance-oriented production (D'Mello, 2003). The challenge for traditional animal nutrition is therefore to adapt the nutrient supply as accurately as possible to the requirements of the animals resulting from maintenance and performance.

Animal nutrition in organic livestock production also has to take the availability of nutrients in organic agriculture and the nutrient flow within the individual farm system into account. In practice, both aspects have a high influence on the formulation of diets. There is a clear difference between an approach based solely on the specific nutritional requirements of animals and the system oriented organic approach. This leads to a shift in the management priorities, and often is the reason for misunderstanding between organic and conventional production.

One of the main objectives of organic agriculture is to optimise the use and the efficiency of nutrients limited in their availability within the farm system, and, simultaneously, to produce animal products of high quality in a way that is compatible with the needs of both the animals and the environment (Sundrum, 2001). Realising such a system-oriented approach usually requires a complete re-organization of the farm, in which cropping has to be tailored to the concerns of animal husbandry and the size and type of animal husbandry adapted to home-grown feedstuffs. The aim is to achieve animal and environment compatible production of animal products principally through precautionary and avoidance strategies.

This approach is quite different from an increase in the use of nutrients in order to maximise protein accretion as is the case in conventional animal nutrition.

With regard to the different objectives, different priorities, and different framework conditions, organic and conventional livestock production represent completely different farm systems. Therefore, the traditional approach which reduces agricultural problems to the level of single production traits is not directly comparable with the organic one, and conclusions derived from conventional production system have not the same validity in organic livestock production.

Protein accretion and protein sources

Protein accretion in the organism is the result of protein synthesis rate and decomposition rate; both are influenced to a high degree by the genotype. Under conventional conditions, farmers intend to maximise protein accretion for economical reasons by using genotypes with a high growth capacity and by increasing the supply of limited amino acids through increasing their concentration in the feed ration. Due to the restricted availability of limited amino acids in organic livestock production, the protein accretion capacity is clearly limited. The organic farmer is challenged to optimise the use of limited resources. For several reasons, the farm should try to adapt the level of amino acid supply to the protein accretion capacity of the

animals as suboptimal supply reduces the performance while excess supply with amino acids cannot further increase performance.

Concerning nutritional resources, there are high aspirations to use home grown protein sources in organic systems. Conventionally produced protein sources listed in Appendix II C of the EEC-Regulation can only be used until the end of the transition period. Factors such as amino acid availability, metabolisable energy and fibre content, digestibility, and type and quantity of anti-nutritive factors will influence the maximum inclusion rate of home grown protein sources. Thus, a feed ingredient that has low protein content or a deficit of one essential amino acid may be considered valuable if it has other useful attributes. There are several types of grain legumes with distinct nutrient content. The crude protein content can vary, according to variety, between 26 and 45% (Table 1).

Tab. 1.: Crude protein content of home grown grain legumes (in %) and content of essential amino acids (in g/kg DM)

	Feed	Faba	Sweet lupins		
	peas	beans	White	Blue	Yellow
Crude protein (%)	26	28	36	34	44
Lysine (g)	18.2	17.6	16.9	16.3	22.4
Methionine/Cystine (g)	6.2	5.6	7.2	7.5	11.0
Threonine (g)	9.9	9.8	13.7	11.9	14.1
Tryptophan (g)	2.3	2.5	2.9	2.7	3.1

Sources: Degussa, 1996; Bellof et al., 1997

The challenge to meet the protein requirements under organic conditions arises in particular in replacing conventional ingredients in organically produced compound feeds. Organically produced feedstuffs that could potentially be included are in particular various expeller cakes (oil produce where the fat has been removed through physical pressure) and milk products. The nutrient content of several protein-rich feedstuffs are presented in Table 2. In relation to the feed value the content of lysine and methionine is particularly decisive and components vary also other essential amino acids, fat and energy contents. Every feedstuff shows specific advantages and disadvantages, which need to be taken adequately into account in formulating the feed ration.

Soya products have a very favourable amino acid pattern, which explains their importance in conventional feedstuffs, and are expected to be used increasingly also in organic agriculture. Soya products have to be toasted, due to their high ANF content. Compared with extracted Soybean meal, full fat has a very high fat content limiting its possible use. Also with regard to some other cakes special attention has to be paid to the fat content.

Tab. 2: Contents of protein supplement feedstuffs in relation to conventional soybean meal

	Soybean meal	Soya full-beans	Rape cake	Sunflow. cake	Flax cake	Non-fat milk powder	Whey powder (de-sugared)
Crud. Prot. (%)	45.2	35.2	37.0	42.8	33.5	35.0	23.9
Lysine (g)	28.3	22.2	17.9	14.9	11.7	28.0	18.0
Meth+Cyst (g)	13.0	10.8	11.7	14.3	11.6	11.9	8.1
Threonine (g)	17.9	14.1	14.4	16.1	12.9	15.9	13.3
Tryptophan (g)	5.9	4.8	4.4	5.6	6.3	5.0	3.7

Source: Jeroch et al., 1993; Degussa ; 1996

Possibilities of the farm management

Due to the high variation in availability, feed intake, digestibility and utilization of amino acids between farms, and the variation in protein accretion between species and between the genotypes within species there is need to target recommendations more closely related to the farm specific situation. However, the following measures could be used by organic farmers in working towards 100% organic diets:

- use of slow growing strains, thus reducing nutritional requirements of the farm animals in the different stages of the development;
- increase of feed intake by means of optimisation of the feeding and housing conditions, thus enabling a reduction of the concentration of limited amino acids in the feed ration and of the demand for high quality protein feeds;
- increase of feed intake by reducing the energy content of the diet;
- implementation of a multiple phase feeding, thus adapting the supply more closely to the requirements in the different stages of production;
- implementation of sexually divided housing to adapt the supply more closely to the different requirements of the genders;
- use of compensatory growth effects, thus reducing the demand for feedstuffs of high quality protein;
- purchasing of organic protein sources of organic origin, like rape cake, soybean cake, or skim milk powder to compensate for the previous use of non-organic feedstuffs.

Examples of feed rations based on 100 % organic feedstuffs indicate that, in general, it is possible to formulate diets without the use of non-organic feedstuffs. However, the preferred use of home-grown feedstuffs and limitations in the choice of bought-in feedstuffs can be the cause of a huge variation in the composition of diets. This increases the demand for analysis of the ingredients and the farm specific calculation of the diet.

In line with the principles of organic agriculture, the various management possibilities to compensate for a limited availability of high quality feedstuffs should be given first priority. Whether the supply with limited amino acids at the farm is in accordance with the requirements is not primarily due to the EEC-Regulation, but is to a high degree related to the skills of the farmer to deal adequately with the situation within the farm system. It is likely that these compensatory measures will lead to some increase the production costs, but because of different factors involved the effect will be different under different farm situations.

Outlook

The participants of the EU project are aware that they deal with a very comprehensive and complex issue, and that important aspects and studies that are of current interest may not yet have been considered. In particular, we realise that our choice of issues considered so far may to a certain degree depend on our personal perspective and on the problems which may be predominant in our own country. We have released a draft version of the preliminary report on the project website (see www.organic-revision.org) in order to receive feedback from different perspectives on the information gathered so far. In particular, we would like to receive feedback on aspects predominating in the different European countries and on further references and studies that we should consider.

References

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